

# The Effects of an Electronic Medical Record on Patient Care: Clinician Attitudes in a Large HMO

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**Objective** The purpose of this study is to examine the attitudes of clinicians in a large HMO toward the effect of an outpatient Electronic Medical Record system on the quality of patient care. Attitudes toward a Results Reporting system and an online charting and ordering system are also compared.

**Design** A cross-sectional study was performed using a survey of Kaiser Permanente Northwest clinicians. In addition, interviews were conducted with the physician leaders of the clinical departments at Kaiser Permanente Northwest.

**Measurements** Clinician attitudes are measured regarding the effects of a Results Reporting system and an online charting and ordering system on the overall quality of patient care and other care-related indices.

**Results** Most clinicians feel that the outpatient Electronic Medical Record has improved the overall quality of patient care, with 72% reporting an improvement with the use of the Results Reporting system, and 60% reporting an improvement with the use of the online charting and ordering system. On average, clinicians feel that the EMR has also improved the quality of the patient-clinician interaction, the ability to coordinate the care of patients with other departments, the ability to detect medication errors, the timeliness of referrals, and the ability to act on test results in a timely fashion.

**Conclusion** Clinicians perceive an improvement in patient care as a result of using an outpatient Electronic Medical Record system. Clinicians have higher opinions, however, of the effects of a Results Reporting system compared to an online charting and ordering system.

## INTRODUCTION

A growing list of physician practices and health systems are implementing outpatient Electronic Medical Record (EMR) systems. The decision to purchase these systems, however, is often based on their proposed administrative rather than clinical benefits. A growing body of literature suggests patient care can be positively affected by the use of these systems, but these studies have usually addressed the effects of specific

technologies, such as reminder systems or clinical practice guideline systems, in controlled environments. Little has previously been known about the attitudes of clinicians in community practice toward a comprehensive outpatient EMR system and its effects on patient care. More information has been needed, too, about which components of EMR systems have the greatest perceived effect on patient care.

This study examines the attitudes of clinicians in community practice experienced in the use of a comprehensive outpatient EMR system. The study evaluates their attitudes toward the effects of an EMR on patient care, as well as their reactions to the use of two very different electronic record system components--each requiring different levels of skill and time. This evaluation should enhance our understanding of how clinicians perceive the clinical effects of the outpatient Electronic Medical Record, resulting in improved sensitivity and attention to the concerns and needs of community clinicians who want to adopt these systems for their own practices.

## BACKGROUND

Kaiser Permanente Northwest serves over 430,000 members in Oregon and Southwest Washington. From 1991 to 1994, the outpatient Electronic Medical Record system of Kaiser Permanente Northwest (KPNW) underwent the first of two developmental phases. In the first phase, a Results Reporting System (RRS) was implemented throughout the division. RRS is a read-only computerized reporting system developed at KPNW allowing clinicians to review laboratory tests, dictated reports, prescriptions, appointments, and admission data. The second implementation phase began in 1994 when clinicians began using EpicCare, an online charting and ordering system developed by Epic Systems of Madison, Wisconsin. Clinicians use EpicCare to enter encounter notes, enter prescriptions for the pharmacy, order lab and diagnostic tests, construct problem and current medication lists, enter diagnoses, and make patient referrals. EpicCare also incorporates guidelines for medication ordering, referrals, and test ordering. Clinicians generally type their own encounter note into

EpicCare in their office immediately following the patient visit or at the end of the day. Currently, all clinical departments except Emergency Services are using EpicCare for all patient visits, resulting in over 3 million patient encounters currently in the EpicCare database. Previous studies from KPNW have examined the early utilization of Results Reporting<sup>1</sup>, and the early effects of EpicCare on physician productivity<sup>2</sup>. A complete description of these systems has been published elsewhere<sup>3</sup>.

Clinicians must see EMR systems as adding value to their work if these systems are to be successfully incorporated into the process of outpatient care<sup>4</sup>. As stated by Glyn Hayes, "If there is no perceived benefit from the (EMR) the clinician will prefer to retain the paper record... The system has to provide some 'added value' during that encounter if the clinician is to be persuaded to use it<sup>4</sup>." Perhaps the most important added value of an EMR is its contribution towards improved patient care.

Studies examining the effects of Electronic Medical Record systems on patient care have addressed (1) their potential for enhancing the availability of important clinical information such as laboratory and diagnostic test results<sup>5</sup>, (2) the effectiveness of specific decision support tools on patient care outcomes<sup>6-11</sup> and (3) the use of practice databases to characterize patient populations and predict patient outcomes<sup>12</sup>. Anderson has provided a review of the potential advantages of the Electronic Medical Record for patient care, as well as the barriers to EMR implementation and possible methods of changing physicians' practice behavior<sup>13</sup>.

Other proposed benefits of Electronic Medical Record systems for patient care include the ability to reduce the number of medication dosing errors, drug reactions, and drug-drug interactions,<sup>14</sup> and enhance communications necessary for the coordination of patient care between primary and specialty care departments<sup>15</sup>. The benefits of the Electronic Medical Record are also being extended directly to patients, enabling providers to print patient education material and personalized patient information<sup>16</sup>. The outpatient EMR system in use at Kaiser Permanente Northwest offers many of these proposed benefits to patient care.

## METHODS

A cross-sectional study was performed using semi-structured interviews and a survey of Kaiser Permanente Northwest clinicians. The clinicians participating in this study included physicians (MD, DO and DPM) and affiliated clinicians (Physician Assistants, Nurse Practitioners, Optometrists and mental health professionals). Interviews were conducted with physician leaders of the clinical departments, consisting of open-ended questions about the effects of the EMR on patient care. Also, the *Electronic Records and Patient Care*

survey--consisting of 65 questions relating to background information, computer experience, and perceptions of the impact of the EMR on patient care-- was distributed to all KPNW clinicians who use both RRS and EpicCare (all clinicians except those in Emergency Services).

Clinicians were asked to assess how Results Reporting and EpicCare have separately affected the overall quality of healthcare they give their patients from "much worse" to "much better." Clinicians were also asked to assess how these systems affect the quality and content of their patient-clinician interaction. The responses for each system were compared using a paired-samples t test.

Some patient care issues are affected primarily by EpicCare (adherence to clinical practice guidelines, detection of medication errors, coordination of patient care with other departments, and patient referral) or primarily by RRS (ability to act on test results in a timely fashion). For these items, the mean response for either EpicCare or RRS is compared to a mean of 3.0, or "Same," using an independent samples t test.

Using a 10-point scale, clinicians were also asked to rate the relative effort required to use RRS and EpicCare and their relative benefit to patient care. The mean Benefit score, the mean Effort scores, and the mean Benefit / Effort ratios for each component are compared using a paired-samples t test.

## RESULTS

Nineteen of 27 physician leaders were interviewed, including five primary care physicians and fourteen specialty care physicians. Excerpts from these interviews are presented in the Discussion section below.

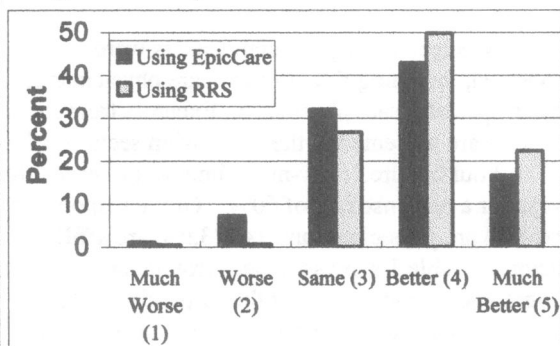
Four hundred forty-nine clinicians returned the surveys for a response rate of 60%. Of the respondents, 299 (68%) are physicians, and 143 (32%) are affiliated clinicians. Table 1 shows the background and demographic characteristics of the respondents. The average respondent was significantly younger than the average KPNW clinician ( $p=.002$ ), but there was a difference of only one year between the groups (46 vs. 47 years). There were no differences between respondents and all KPNW clinicians in the percentages of physicians vs. affiliated clinicians, department type (primary vs. specialty care), or gender.

**Table 1 Characteristics of Survey Respondents (N=449)**

Characteristic	n*	Mean $\pm$ S.D., or %
Age	432	46 years $\pm$ 7 years
Gender	438	62% Male
Professional Title	299	68% Physicians
	143	32% Aff. Clinicians
Department Type	177	43% Primary Care
	233	57% Specialty Care
Length of time using EpicCare	435	19 months $\pm$ 10 months
Time with current department	438	9 years $\pm$ 7 years
Own a computer	448	Yes = 85%

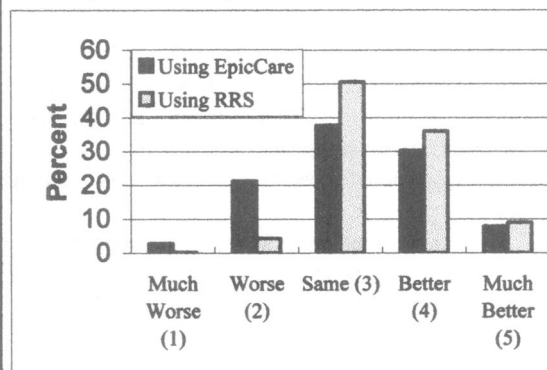
\*Some numbers do not total 449 due to missing values.

Sixty percent of respondents felt that using EpicCare has improved the overall quality of care, compared to 32% who felt that care has not been affected and 8% who felt care is worse. Seventy-two percent of respondents felt that RRS has improved the quality of patient care, compared to 27% who felt care has not been affected and 1% who felt care is worse. (Figure 1) The differences in the responses for EpicCare and RRS are significant ( $p < .001$ ).

**Figure 1.** "How has the overall quality of health care that you give your patients been affected as a result of using RRS and EpicCare?"

$p < .001$  EpicCare vs. RRS (paired samples t test)  
The mean response for EpicCare = 3.67, RRS = 3.93

Forty-five percent of respondents felt that RRS has improved the quality and content of their patient-clinician interaction, compared to 51% who felt RRS has had no effect and 4% who felt this interaction has worsened as a result of using RRS (Figure 2). Thirty-eight percent of clinicians felt that EpicCare has improved the quality and content of their patient-clinician interaction, compared to 38% who felt EpicCare has had no effect and 24% who felt that their interaction has worsened as a result of using EpicCare. The differences between the responses for RRS and EpicCare are again significant ( $p < .001$ ).

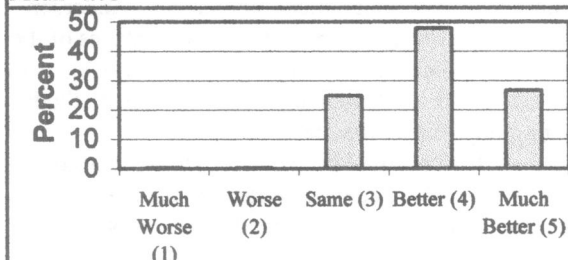
**Figure 2.** "How has the quality and content of your clinician-patient interaction been affected as a result of using RRS and EpicCare?"

$p < .001$  EpicCare vs. RRS (paired samples t test)  
The mean response to EpicCare = 3.19, RRS = 3.49

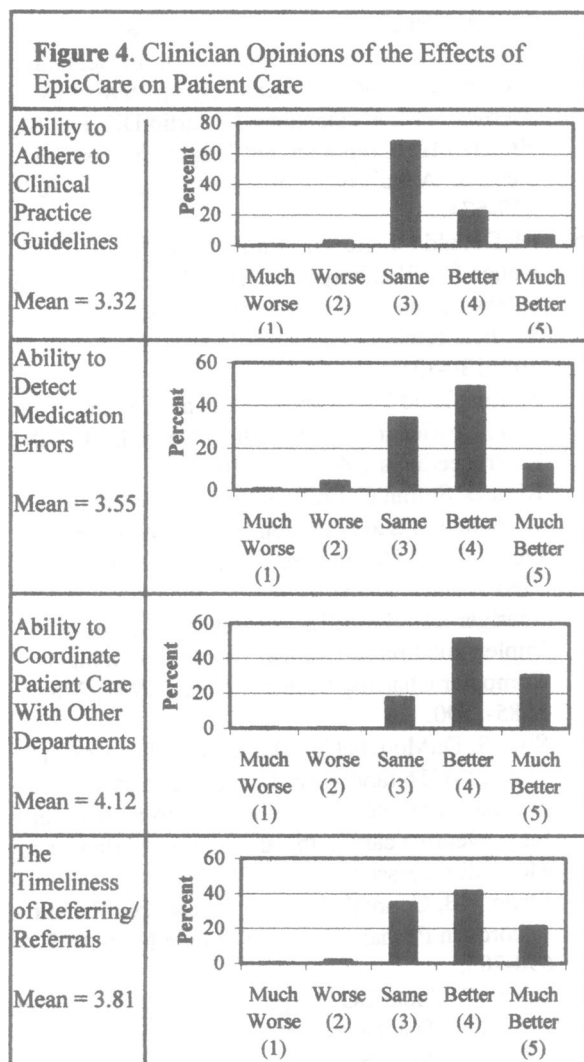
When asked about the specific benefits for Results Reporting, 74% of respondents felt that RRS has improved their ability to act on test results in a timely fashion (Figure 3).

**Figure 3.** Clinician opinions of the effects of RRS on the ability to act on test results in a timely fashion.

Mean = 4.01



When asked about the specific benefits for EpicCare (Figure 4), 82% of respondents felt that EpicCare has improved their ability to coordinate the care of patients with other providers and departments, and 63% felt that EpicCare has improved the timeliness of patient referrals. Although only 29% of respondents felt that EpicCare has improved their ability to adhere to clinical practice guidelines (compared to 68% who felt this ability has not been changed), 61% felt that EpicCare has improved their ability to detect medication errors, including dosing errors, adverse drug reactions and drug-drug interactions. The mean response for all questions was significantly higher than 3.0 or "Same."



The relative benefit to patient care and effort required to use RRS and EpicCare are presented in Table 2. Clinicians were asked to report the benefit of RRS and EpicCare to patient care on a scale from 1 to 10 (10 = a great deal of benefit). The mean response for RRS was 7.3, compared to 6.9 for EpicCare ( $p < .001$ ).

Clinicians were also asked to report the effort required to use RRS and EpicCare on a scale from 1 to 10 (10 = a great deal of effort). The mean response for RRS was 3.0, compared to 5.9 for EpicCare ( $p < .001$ ). The benefit / effort ratio was calculated for RRS and EpicCare for each respondent. When these ratios are averaged, the mean benefit / effort ratio for RRS is 3.1, compared to 1.8 for EpicCare ( $p < .001$ ).

**Table 2 Relative Effort and Benefit of EMR Components**

	EpicCare Mean $\pm$ S.D.	RRS Mean $\pm$ S.D.	p value
*Benefit to patient care	6.9 $\pm$ 2.2	7.3 $\pm$ 2.0	<.001
*Effort required	5.9 $\pm$ 2.6	3.8 $\pm$ 2.2	<.001
#Benefit / Effort ratio	1.8 $\pm$ 1.8	3.1 $\pm$ 2.6	<.001

\*Maximum score = 10 (great deal of Effort or Benefit)

# Represents the average of the individual ratios of benefit / effort provided by clinicians, NOT the ratio of the average benefit and effort scores shown above.

## DISCUSSION

The purpose of this study is to examine the attitudes of clinicians in community practice experienced in the use of a comprehensive outpatient EMR system. Understanding the perceived benefits of EMR systems to patient care should help encourage the diffusion of these systems. Evaluating the differences in the perceived impact of a read-only Results Reporting system and an advanced online charting and ordering system may help clinicians to prioritize the implementation of these different EMR components.

KPNW clinicians felt on average that both the RRS and EpicCare components improve the quality of patient care. With a salaried clinical staff of over 750 and the close relationship of Northwest Permanente to Kaiser Permanente Health Plan, KPNW does not represent the average community medical practice. This study does not address the additional difficulties encountered when implementing an EMR in clinician practices with multiple payer contracts and fee-for-service billing.

Clinicians felt that both RRS and EpicCare have benefits, but that RRS has a greater impact on the quality of patient care. Clinicians also believe that RRS is more beneficial to the patient-clinician interaction. This may be a result of the belief by many clinicians that electronic charting takes away from the time they are able to spend in the exam room and adds time to their workday. The differences in attitudes between the two systems may lessen when EpicCare has been in use as long as Results Reporting. The initial findings of a recent KPNW pilot study indicate that having EpicCare terminals in the exam rooms may also substantially improve clinician opinions of EpicCare. For now, the speed of RRS and the data entry required to use EpicCare appear to contribute to more favorable opinions of Results Reporting. In the words of KPNW clinicians:

*"People are spending more time at work, and even though the value of the record is good, a lot of people feel that we are spending too much time entering data into EpicCare."*

*"Results Reporting was a gift from God. It was what I had been waiting for for years."*

KPNW clinicians, however, feel that both systems offer more benefit to patient care than the effort required to use them.

*"With EpicCare, care can now be more specific, more guided, more timely and more appropriate."*

*"When patients feel that you are informed they feel amazingly secure. When you know what happened in their primary care visit that morning, or if you have a complex case, they like to know that there is a team approach to taking care of them. We don't hear 'God, why don't you guys talk to each other' any more."*

## CONCLUSION

Clinicians perceive a significant improvement in patient care as a result of using an outpatient Electronic Medical Record system. They perceive greater benefit with the use of a Results Reporting system than with an online charting and ordering component, although both are perceived to significantly improve patient care. The results of this study indicate that the most important capability of an electronic record system continues to be its ability to retrieve critical information, such as lab results, prescribed medications, and dictated reports, at the point of care.

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